Government decentralization and disaster impact, an exploratory study

Alain Vaillancourt
Hanken School of Economics, Humanitarian Logistics Institute, Helsinki Finland.
(Email: alain.vaillancourt@hanken.fi)

Abstract

The purpose of this study is to explore the link between decentralization and the impact of natural disasters through empirical analysis. It addresses the issue of the importance of the role of local government in disaster response through different means of decentralization. By studying data available for 50 countries, it allows to develop the knowledge on the role of national government in setting policy that allows flexibility and decision making at a local level and how this devolution of power influences the outcome of disasters. The study uses Aaron Schneider's definition and rankings of decentralization, the EM-DAT database to identify the amount of people affected by disasters on average per year as well as World Bank Indicators and the Human Development Index (HDI) to model the role of local decentralization in mitigating disasters. With a multivariate regression it looks at the amount of affected people as explained by fiscal, administrative and political decentralization, government expenses, percentage of urbanization, total population, population density, the HDI and the overall Logistics Performance Indicator (LPI). The main results are that total population, the overall LPI and fiscal decentralization are all significant in relation to the amount of people affected by disasters for the countries and period studied. These findings have implication for government's policies by indicating that fiscal decentralization by allowing local governments to control a bigger proportion of the countries revenues and expenditures plays a role in reducing the amount of affected people in disasters. This can be explained by the fact that local government understand their own needs better in both disaster prevention and response which helps in taking the proper decisions to mitigate the amount of people affected in a disaster. The reduction in the implication of national government might also play a role in reducing the time of reaction to face a disaster. The main conclusion of this study is that fiscal control by local governments can help reduce the amount of people affected by disasters.

Keywords: Disaster resilience, decentralization, local government.

1. Introduction:

The purpose of this study is to explore the link between decentralization and the impact of natural disasters through an empirical analysis of relevant data. It addresses the issue of the importance of the role of sub-national (regional, local) governments in disaster response using three measures of decentralization. This is of interest since there are typically many different actors that are involved in disasters (Kovàcs & Spens, 2007) and each of these actors has different tools and options available that define their scope of activity in normal activities and during each disaster phases. One of these actors which is always present and in some situations is the main driver behind disaster response is the government. Action of governments can impede or accelerate disaster relief for instance through the exercise of custom powers (Amin & Goldstein, 2008) or the use of well-disciplined groups such as such as the military of the country affected by the disaster (or the military of other countries) (Barber, 2012). The role of the government can thus be quite important in deciding policies and activities that are to be followed in disasters. However, there are usually in countries different levels of governments-central, regional, local-that can intervene when a disaster strikes. It is not always the case that the responsibilities in case of disaster are clearly set out. The recently adopted Kenyan constitution is one example where an attempt is made to clarify responsibilities by making the central government responsible for disasters while counties are responsible for disasters and fire protection (Attorney General, 2010).

The relationship between the decentralization of the governmental powers and the impact of disasters is a subject that has been addressed by only a few papers in literature. All but one articles use the number of deaths as their measure of the impact of disasters (Skidmore & Toya, 2013; Toya & Skidmore, 2010; Yamamura, 2012; Escaleras & Register, 2012).Only one article uses also the number of affected people as a dependent variable in its analysis (Meherun & Kari, 2009). In recent years the amount of people killed in disasters is substantially smaller than the amount of people affected. Indeed, for the period 2007-2012 there was an average of 105,297 people killed and 198,467,758 people affected per year (EM-Dat, 2012). The articles that address disaster impact and decentralization do so using long time series and include control variables such as levels of schooling, (Toya & Skidmore, 2010; Skidmore & Toya, 2013) or ethnic fractionalization (Yamamura, 2012). This study uses as its dependent variable in the empirical analysis the total number people affected over a recent time period (2007 to 2010) which dates are not covered by previous studies, it also includes logistics performance, only available for that period as one of the independent variables to control for access to disaster areas to respond to the need of affected people. This is the first time to our knowledge that both these independent variables are used simultaneously in this type of analysis. The outcome of the analysis can help in contributing to disaster management analysis of the role of government and logistics in disaster. This paper is divided as follows: first it addresses definitions relative to the subject, it then explains the data and the method uses, this is followed by the results and their analysis and it ends with an explanation of the limitations of this research.

2. Definitions:

To better understand the different main variables and how they interact together it is important to have proper definitions for each as well as clarifying to which field they apply. This is the case for decentralization which is relevant in both logistics and government fields. Since government policy is important in both decentralization decision and logistic performance which regulates access to all major actors in a disaster, the role of logistics in the humanitarian setting is also presented. Furthermore, the notion of resilience is addressed as well to understand how government can influence its outcome.

2.1 Decentralization

Decentralization is a notion that pertains to the structure of an organization which finds itself with strong centres of power at various organizational levels. It can be seen either as a process or as the state of an organization and can be applied in multiple fields that study organization such as businesses and governments. With this in mind it is thus important to define appropriately what decentralization is since the study includes logistics performance which has its own understanding of decentralization. Logistics looks at decentralization as a strategic issue that aims to define how an organization chooses at which organizational level it concentrates goods or other intangible assets in order to obtain the desired output. There are multiple aspects of a firm that can be looked at. For instance when taking into account logistics integration decentralization can make lower level of the organizations being more efficient due to the lesser need of information system support (Stank et al., 1994). Or when looking at logistic service innovation where decentralization is a positive driver of logistic innovation (Daugherty et al., 2011) and helps in low cost incremental innovation (Germain, 1996). However when dealing with decentralization in logistics it is not the flow of information, ideas and knowledge but rather the flow of goods that is the issue of interest. Thus, logisticians are interested in understanding at which point in their network should they put certain amount of goods to insure a timely delivery at the appropriate cost. This can range from taking complex strategic decisions like choosing how many and where the warehouses of goods would be (Nakatsu, 2005) to more tactical considerations such as how much safety stock and in which warehouse to store it to achieve business objectives (Zinn et al., 1989).

Furthermore by including logistic decentralisation in the management of the complete supply chain the use of safety stocks along the logistic network allows for a more timely response. This goal can also be achieved through operations management methods inside the logistics chain an example of this would be delayed product differentiation (Lee & Tang, 1997). The structure of the logistics network of a firm will also be influenced by other internal factors such as in what subparts (profit centres, divisions,…) the firm is broken up into and how it manages its synergies and conflicts (Pirrtilä & Niemi, 1996) Overall decentralisation in logistics plays the role of helping an organization find the right fit between the logistics requirements and the supply chain structure. It can be seen as a way to balance a trade off between the governance of the supply chain and the geographic dispersion of the chain (Stock et al., 2000).This question of governance and power in the supply chain is one that is also seen in governmental decentralization.

Decentralization from the point of view of government also approaches similar issues related to the structure of its organization. However instead of looking at how goods, business innovation and knowledge are transferred in between different levels of an organization, governmental decentralization looks at how power is allocated at different levels. Some argue that decentralisation achieves the best possible outcomes for the residents of a country (Wallis & Oates, 1988) while others argue that government decentralization can be seen as a way to limit the overall size of government (Joulfaian & Marlow, 1990; Cassette & Paty, 2010). As the outcome of Hurricane Katrina in 2005 shows, the distribution of powers between different government agencies can matter (Garnett & Kouzmin, 2009). This was highlighted with the differences between the response from FEMA and the Coast Guard which had different power structures in relation to the US federal government (Horwitz, 2008).

The decentralization of government is accomplished by the sharing of powers between levels of government taking into account factors such as economies of scale, heterogeneity in preferences and externalities. There are different types of power that can be decentralized through different means (Figure 2). There are different ways to split decentralisation in governments. One such split identifies four different areas, political, administrative, fiscal and economic decentralization (Regmi et al., 2010). The last one of these is not of interest for this study since it implies the privatization of the market and not transfers of power inside the levels of government. These different types of decentralisation allow the regional and local governments to better respond to the needs of their residents (Faguet, 2004). In this sense it improves efficiency in that it helps governments allocates good and services in a way that better matches the need of the local population as well as improve the delivery of government services (Barankay & Lockwood, 2007). It is governmental decentralization captured using three measures that will be used to understand the role of government in reducing the impact of disasters.

2.2 Logistics in the humanitarian setting

Logistics is often seen as “having the right item in the right quantity at the right time at the right place for the right price in the right condition to the right customer” (Mallik, 2010). However in humanitarian logistics, customers are usually seen as beneficiaries because it is not them paying for the goods or their delivery. The complexity of addressing humanitarian logistics issues can be understood by the different actors that need to access the aid supply network (figure 1). Logistics plays an important role in the humanitarian setting by enabling the multitude of actors involved in relief and recovery to access disaster zones and helping deliver aid and respond to the need of the victims.

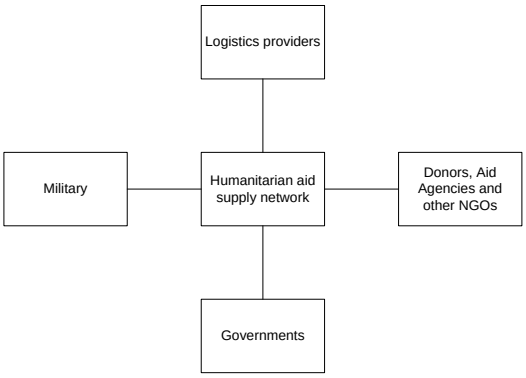

Figure 1: Actors in the supply network of humanitarian aid adapted from Kovàcs and Spens (2007)

A previous study has shown that average Logistics Performance Indicators were significantly correlated with reducing the amount of people affected (Haavisto, 2012). Its importance can be seen in the cost that aid agencies incur, indeed logistics cost can be up to 40% of programme costs compared to the commercial sector which is estimated at around 15% of operational costs (Whiting & Ayala-Ostrom, 2009). An increase in logistics performance can thus have an impact on the expenses of the programme by reducing the overall logistics cost and increase other expenses that are related to relief. Another important factor in the case of disaster is the timeliness of the response (Petit & Beresford, 2009) which can be affected by the country's logistic performance.

2.3 Disaster impact and disaster resilience

Disaster impact is a notion that can be measured through both human and economic losses (Noy, 2009). Whether it is looking at the economic impact on livelihoods such as economic losses of farmers in droughts (Barnett, 1999)or looking at the number of people killed and affected (Strömberg, 2007) or even looking at the psychological toll (Norris & Murrell, 1988) there is no single standard for measuring the impact of disaster. However, for the purpose of this study the number of affected people will be used as it more amenable to ex-post government responses and is far more important than the number of deaths; indeed for the 1988 to 2010 period the amount of people affected worldwide by natural disasters was 5,226,461,623 while the number of people killed in natural disasters was 2,421,910 (EM-Dat, 2012).

Disaster resilience is the concept that people affected by a disaster can return to a state equivalent to the one they were in previous to the disaster with the least cost and time as possible preferably without outside help (Manyena, 2006). The research on how to increase resilience is carried out in two different strands; the focus is on buildings in engineering journals (Cimellaro et al., 2010) or on people in social science journals (Haigh & Amaratunga, 2010). In both approaches, the government is shown to play a role in improving resilience, public policy can influence the construction of buildings such as hospital in a manner that influence positively resilience (Cimellaro et al., 2010). Since this study looks at a short period of time, it does not take into account such long term structural changes as infrastructure. S.L. Cutter *et al* identify multiple possible community resilience indicators which include many dimensions (social, economic, institutional, infrastructure and community competence) (Cutter et al., 2008) that can

be influenced by the government as an actor. Furthermore, case study findings in Ethiopia seem to point to the fact that demand for resilience programs and structures be beneficiary based (Tadele & Manyena, 2009); achieving this is facilitated by decentralization is important since local government have a better understanding of the needs of the beneficiaries.

3. Data and method

The linear regression model that is used in this paper uses nine independent variables. To explain how the indicators of decentralization were obtained we present the content of Schneider's 2003 article from which they are drawn. The dependent variables and other variables of the model are thereafter presented.

3.1 Indicators of decentralization

The indicators used for decentralization are those found in Aaron Schneider's 2003 article (Schneider, 2003). The data was taken in 1996 and 2001 from the World Bank, IMF and other sources. The fact that these measures are for an earlier period than the other data used is not an issue for the analysis as decentralisation is a process that takes time to take root but is also fairly stable over time.

Type of decentralization	Indicators	Sources
Fiscal decentralization	Sub national expenditures as percentage of total expenditures	Decentralization Statistics, World Bank Website, IMF Government Statistics
	Sub national revenues as percentage of total expenditures	
Administrative decentralization	Taxation as a percentage of sub national grants and revenues	Decentralization Statistics, World Bank Website, IMF Government Statistics
	Transfers as a percentage of sub national grants and revenues	
Political decentralization	Municipal Election	Database of Political Institutions, Country Constitutions, Library of Congress Country Facts, CIA World Factbook
	State Election	

Figure 2: Decentralization dimensions and Indicators adapted from Schneider (Source: Schneider, 2003)

The article by Schneider first narrows down the definition of decentralization and then takes a look at three dimensions of decentralization (fiscal decentralization, administrative decentralization and political decentralization); for each type of decentralization he identified the most significant indicators with a factor analysis. This analysis allows him to determine which indicator is appropriate to explain each type of decentralizations (figure 2). From this factor analysis a total of 68 countries were then analysed to identify what was their factor score to determine their level of decentralization for each dimension. This allows using each of the factorial indicators as a rank that evaluates on a broader scope the different types of decentralization found in governments.

3.2 Total people affected and other variables:

The data for the total number of people affected comes from the EM-Dat database (EM-Dat, 2012) for the period of 2007-2010 and excludes transport accidents and industrial accidents. Disasters are included if 10 or more people are reported killed or 100 or more are reported affected or there is a declaration of a state of emergency or there is a call for international help. Total number of people affected includes the following: people made homeless, people injured and other affected (displaced or evacuated people).

We include control variables to both better model government action and account for other relevant factors; all of the control data comes from World Bank Data (The World Bank, 2013) with the exception of the Human Development Index. They are:

- total government expenses as a share of GDP (G/GDP) to account for the size of the government in the country; we expect a negative impact since this variable is linked to preparedness;
- total population; we expect a positive impact as larger populations will automatically generate more affected people for a given disaster;
- the percentage of urbanization; and population density; these two variables control for the concentration of the population: their expected impact is uncertain as they could both increase the number of affected people (more subject to a given disaster) or reduce it (easier to help clustered victims). Note that over time one expects individuals to settle away from disaster prone areas;
- the overall Logistics Performance Indicator (LPI) is an overall measure of logistic capacity that includes notably the quality of transport infrastructure, the effectiveness of customs and the ability to track and trace shipments all of which are useful in gaining access and delivering supplies in case of disasters; as it increases the amount of people affected should decrease;
- the HDI is a composite indicator that includes life expectancy at birth which controls for health, mean years of schooling and expected years of schooling that control for education level and the gross national income per capital which controls for living standards (United Nations Development Program, 2011). As the HDI increases the amount of people affected is expected to decrease.

4. Results and analysis:

A multivariate regression was estimated for a sample of 50 countries. A multivariate regression was chosen because this method allows looking at an important data set to find out the relationships between the variables. The countries chosen are those from the Schneider list for which all the required information was available and for which such information did not have a value of zero. The log of each variable was used; linear regressions were also estimated but yielded a poorer R-square and less significant results and are not presented here. The format of the regression was the following:

Log (Total people affected) = Constant + Log (Fiscal decentralization) + Log (Administrative decentralization) + Log (Political decentralization) + Log (G/GDP) + Log (Total population) + Log (Population density) + Log (% of urbanization) + Log (HDI) + Log (Overall LPI).

For these 50 countries together the average number of people affected by disasters over the f 2007-2010 period is 46 million people affected per year, with an average of 56 disasters a year for all countries. Each dimension of decentralization was tested in the model simultaneously with only fiscal decentralization appearing as being significant (table 1).

The R-square of the regression is 0.72 which implies that this model offers a good explanation of the determinants of the number of people affected by a given disaster for future disasters. At the 0.05 significance level, there are only three different significant variables in the model: fiscal decentralization, the total population and the overall LPI. The fact that population is highly significant confirms that highly populated country will necessarily have more people affected by a given natural disaster. Since urbanization and population density is not significant the concentration of the human population does not seem to have an impact on the total number of people affected reflecting that this can both increase the number of people affected (+ sign expected)and the capacity of authorities to respond to disasters quickly (- sign expected). With the Overall LPI being significant this shows that logistics performance does play a role in reducing the amount of affected people in disasters. The fact that the G/GDP is almost significant shows that total government expenses play some role in reducing the number of affected people in natural disasters; a finer disaggregation of this spending could perhaps yield clearer results. The HDI being non significant is also surprising since education and GDP were identified as being factors linked to reducing disaster impact (Meherun & Kari, 2009; Skidmore & Toya, 2013). Nonetheless, in these articles the amount of dead or dead and affected was used as the indicator of impact which might have an impact on the type of disaster that comes out. Indeed for the 2007-2010 period earthquakes (53%), storms (25%) and extreme temperatures(10%) are linked to more than 80% (or equal to 80% if the 2010 Haitian earthquake is removed) of the total death while floods (55%), droughts (19%) and storms (12%) are linked more than 80% of total people affected. The difference in the makeup of the mix of disasters might have an impact on which variable is significant since disasters have different characteristics (Kovàcs & Spens, 2009).

Table 1: Linear regression between the log (total people affected in a disaster) and indicators of decentralization over the 2007-2010 period.

Variables	Coef.	Std. Err.	t	P>|t|
Log of Fiscal decentralization	-2.52	1.22	-2.07	0.045
Log of Administrative decentralization	-0.78	1.726	-0.45	0.653
Log of Political decentralization	-0.91	1.549	-0.59	0.559
Log of Percentage of government expenses of GDP	-13.41	8.77	-1.53	0.134
Log of Total population	1.85	0.32	5.76	0
Log of Population density	-0.21	0.33	-0.63	0.533
Log of percentage of urbanization	1.05	15.71	0.07	0.947
Log of HDI	-1.63	4.32	-0.38	0.707

Log of Overall LPI	-8.18	3.54	-2.31	0.026
Constant	-7.62	13.17	-0.58	0.566

Source; calculation by the author

The reason why only fiscal decentralization comes out as significant can be explained by the fact that it represents expenses and revenues by the local government. With administrative decentralization and political decentralization being non significant it is clearly the monetary resources of the local government that allows for a decrease in the amount of people affected. Thus the more the local government spends or earns in revenue, the more it can better prepare for or react to disasters. Depending on the phase of the disaster the regional or local governments can either be in disaster prevention and risk management or in crisis management (Kovàcs & Spens, 2007). In a case study about landslides in Italy Sharma & al. found that decentralization allowed for a far better risk assessment (Sharma et al., 2012). Since fiscal decentralization is significant a more efficient use of government resources in preparation and response to disasters may be to decentralize some of these resources. This paper is one more contribution to the study of the impact of decentralization on the impact of disasters. It shows using more recent data than other papers and adding the logistic dimension that, as in other papers, decentralization can mitigate the impact of disasters on the affected population.

5. Conclusion

This paper has investigated the significance of the link between government decentralization and disaster impact. The purpose of this study is to explore the link between decentralization and the impact of natural disasters through an empirical analysis of relevant data. This study has shown that government decentralization as well as overall logistics performance both plays a role in reducing the number of people affected by disasters in 50 countries over the 2007-2010 period. The evidence from this study suggests that resilience might be improved through decentralized governments which manage their own expenditures and revenues since this type of government decentralization helps reduce the amount of people affected. The findings also seem to suggest that access to the disaster zones through better logistic performance also plays a role in reducing the amount of affected people. This is the first time these two independent variables have been tested together and the level of the R-square seems to indicate that the model presented is somewhat relevant to be able to predict the future. These finding are interesting because they show that decentralization is still significant with recent data using a new dependent variable which is much more important in numbers and livelihoods affected: the amount of affected people. Furthermore, this paper can help national policy makers to understand how they can reduce disaster impact through increased fiscal decentralization and logistic performance improvement.

One of the main limitations for this article is the data which only contains 50 countries. A study covering a larger amount of countries could be helpful in trying to understand the role of decentralization in disaster resilience for reducing the amount of people affected. However, this limited size is explained by the lack of data from the different sources. It thus creates a model that could be tested with more data and completed with other factors affecting disaster impact. Another issue is the fact that the EM-Dat database does not necessarily account for armed crisis, as is the case with the drought in the Sahel in 2012; this crisis was compounded with an armed

independence movement and militant activity in the north of the country. Even though armed conflict are not included, disaster do not necessarily have the same characteristics as conflict and should be treated differently; thus combining both would make the creation of a model quite complex. Another limitation in the EM-DAT database is the fact that disasters do not respect country borders but the data is by country only, meaning one disaster can be recorded multiple times with different data to represent every country it affected. However, when disaster strikes local resources that are country specific might be used and there should be no cross border interventions, sometimes in the case where a call for international help is made, the help does not necessarily come from neighbouring country. This model also has no means to take into account the intensity of the disaster (i.e.: strength of earthquake or hurricane) and would require additional data to take into account all the different aspects that can affect disaster resilience. For instance, it should also take into account the capacity of actors in the humanitarian sector as well as the willingness to fund projects and relief by donors.

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